



**Nemko Test Report:** 12296RUS1


**Applicant:** Fiber-Span  
111 Corporate Blvd., S  
Plainfield, NJ 07080  
USA

**Equipment Under Test:** FS31H-4 RF BDA  
(E.U.T.)

**In Accordance With:** **CFR 47 Part 90, Subpart I**  
Private Land Mobile Repeater

**Tested By:** Nemko USA Inc.  
802 N. Kealy  
Lewisville, TX 75057-3136

**TESTED BY:**

  
\_\_\_\_\_  
David Light, Senior Wireless Engineer

**DATE:** 27 June, 2008

**APPROVED BY:**

  
\_\_\_\_\_  
Mike Cantwell, Frontline Manager

**DATE:** 27 June, 2008

**Number of Pages: 31**

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**EQUIPMENT:** FS31H-4X-USR

**Section 1. Summary of Test Results**

Manufacturer: Fiber-Span

Model No.: FS31H-4X-USR

Serial No.: None

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with CFR Part 90, Subpart I.



New Submission



Production Unit



Class II Permissive Change



Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

See "Summary of Test Data".



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**Summary Of Test Data**

NAME OF TEST	PARA. NO.	RESULT
RF Power Output	90.205	Complies
Occupied Bandwidth	90.210	Complies
Spurious Emissions at Antenna Terminals	90.210	Complies
Field Strength of Spurious Emissions	90.210	Complies
Frequency Stability	90.213	NA

**Footnotes For N/A's:**

- (1) Since the E.U.T. does not contain modulation circuitry modulation testing was not performed.
- (2) Since the E.U.T. is not a keyed carrier system, Transient Frequency Behavior was not performed.

**Section 2. General Equipment Specification****Transmitter**

Supply Voltage Input: 120 Vac

Frequency Range: 464-469 MHz Downlink

457-462 MHz Uplink

**Tunable Bands:**

Type(s) of Modulation:

F3E (Voice)	F1D	F2D	D7W (QAM)	Other
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Gain: 82 dB max

Output Impedance: 50 ohms

RF Power Output (rated):  $\frac{4}{36}$  W  
dBm

Selection of Operating Frequency: None

Power Output Adjustment Capability: Manual

Frequency Translation: 

F1-F1	F1-F2	N/A
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

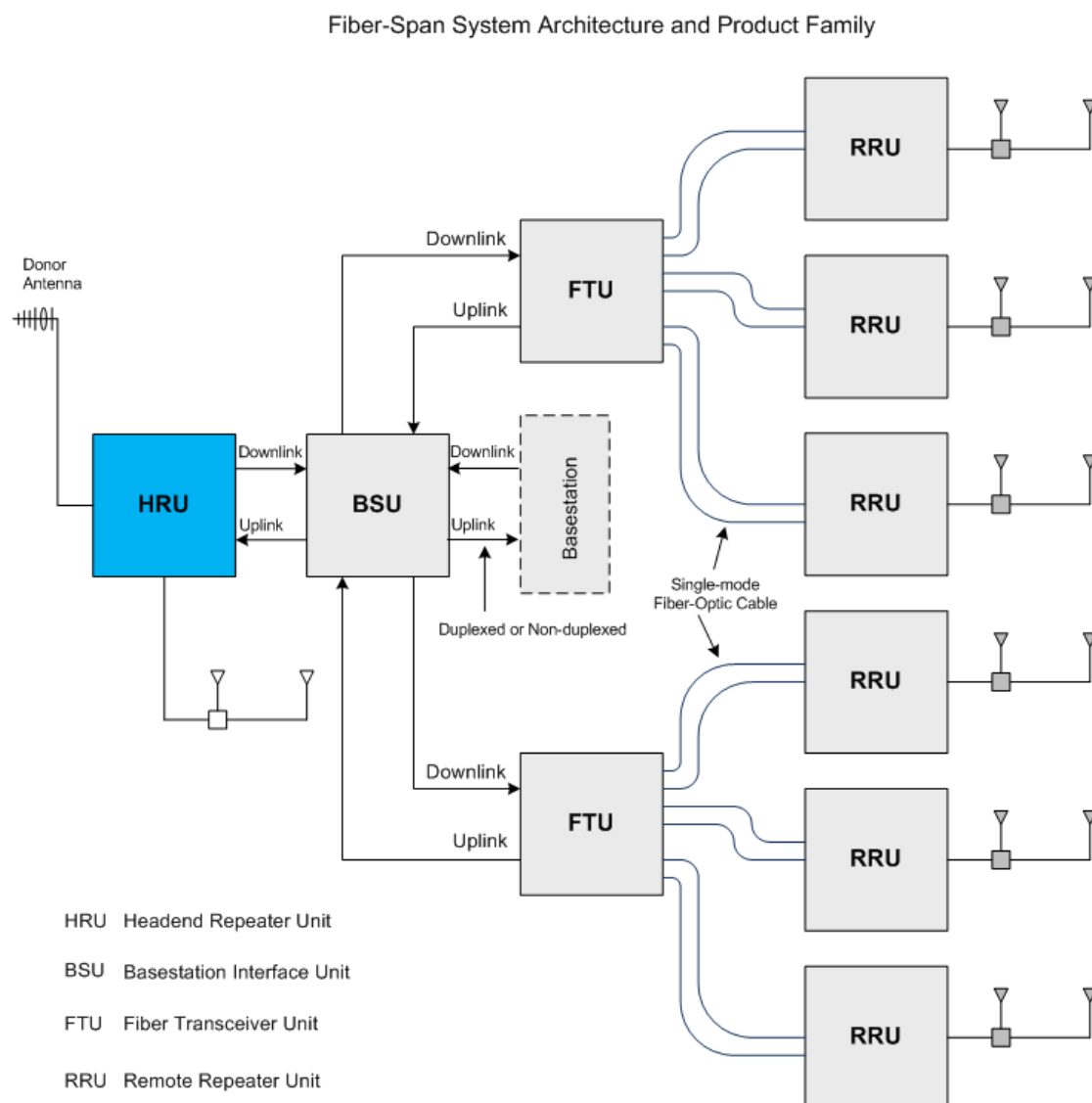
Band Selection: 

Software	Duplexer Change	Fullband Coverage
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

## Description of EUT

The HRU amplifies RF frequencies in both the downlink and uplink paths with duplexers that provide both downlink and uplink frequency bands on a single distributed antenna system. The HRU is used to provide cost efficient wireless coverage in areas that have poor coverage

## System Diagram



**EQUIPMENT:** FS31H-4X-USR**Section 3. RF Power Output**

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: David Light	DATE: 25 June 2008

**Test Results:** Complies.**Measurement Data:**

Direction	Modulation	Output per Channel (dBm)	Composite Power (dBm)	Composite Power (W)
Uplink	Analog	33	36	4.0
Downlink	Analog	33	36	4.0

**Equipment Used:** 1659-1082-1472-1469**Measurement Uncertainty:** +/- 1.7 dB**Temperature:** 22 °C**Relative Humidity:** 35 %

**Section 4.      Occupied Bandwidth**

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: David Light	DATE: 25 June 2008

**Test Results:**                      Complies.

**Test Data:**                        See attached plot(s).

**Equipment Used:**                1659-1082-1472-1469

**Measurement Uncertainty:**   1X10<sup>-7</sup> ppm

**Temperature:**                    22 °C

**Relative Humidity:**           35 %

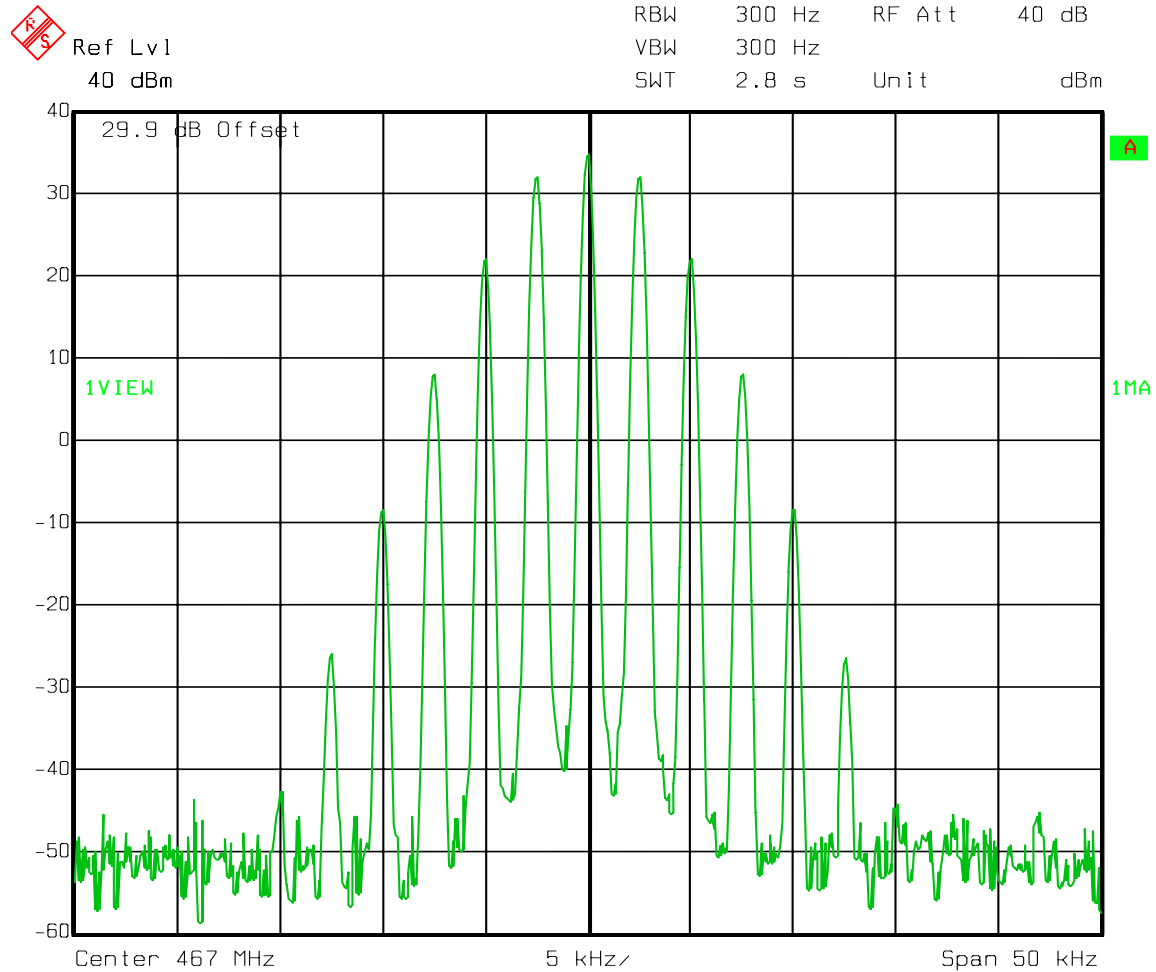


EQUIPMENT: FS31H-4X-USR

### Test Data – Occupied Bandwidth

Downlink / Output

2.5 kHz Tone / 3 kHz Deviation



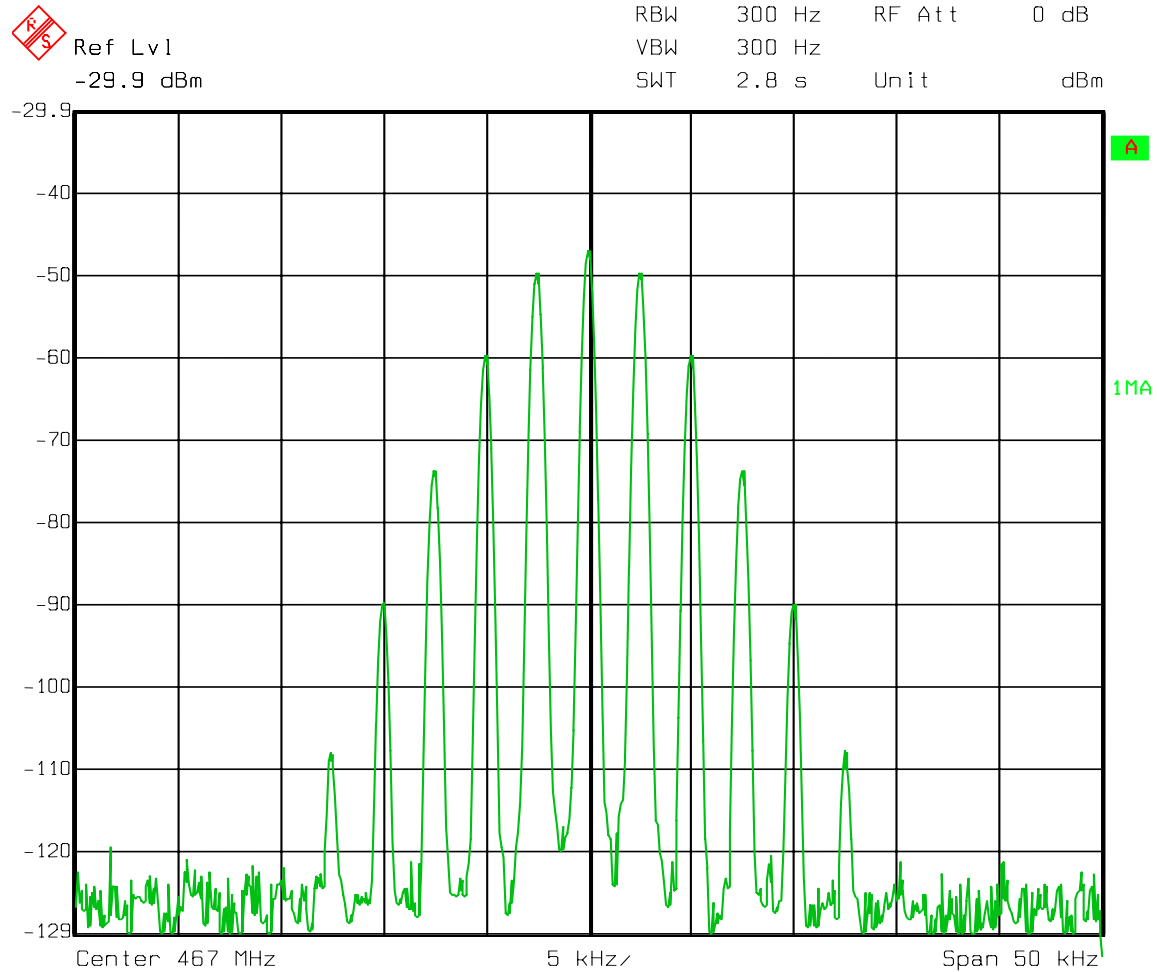
Date: 26.JUN.2008 09:12:54

EQUIPMENT: FS31H-4X-USR

# Test Data – Occupied Bandwidth

Downlink / Input

2.5 kHz Tone / 3 kHz Deviation



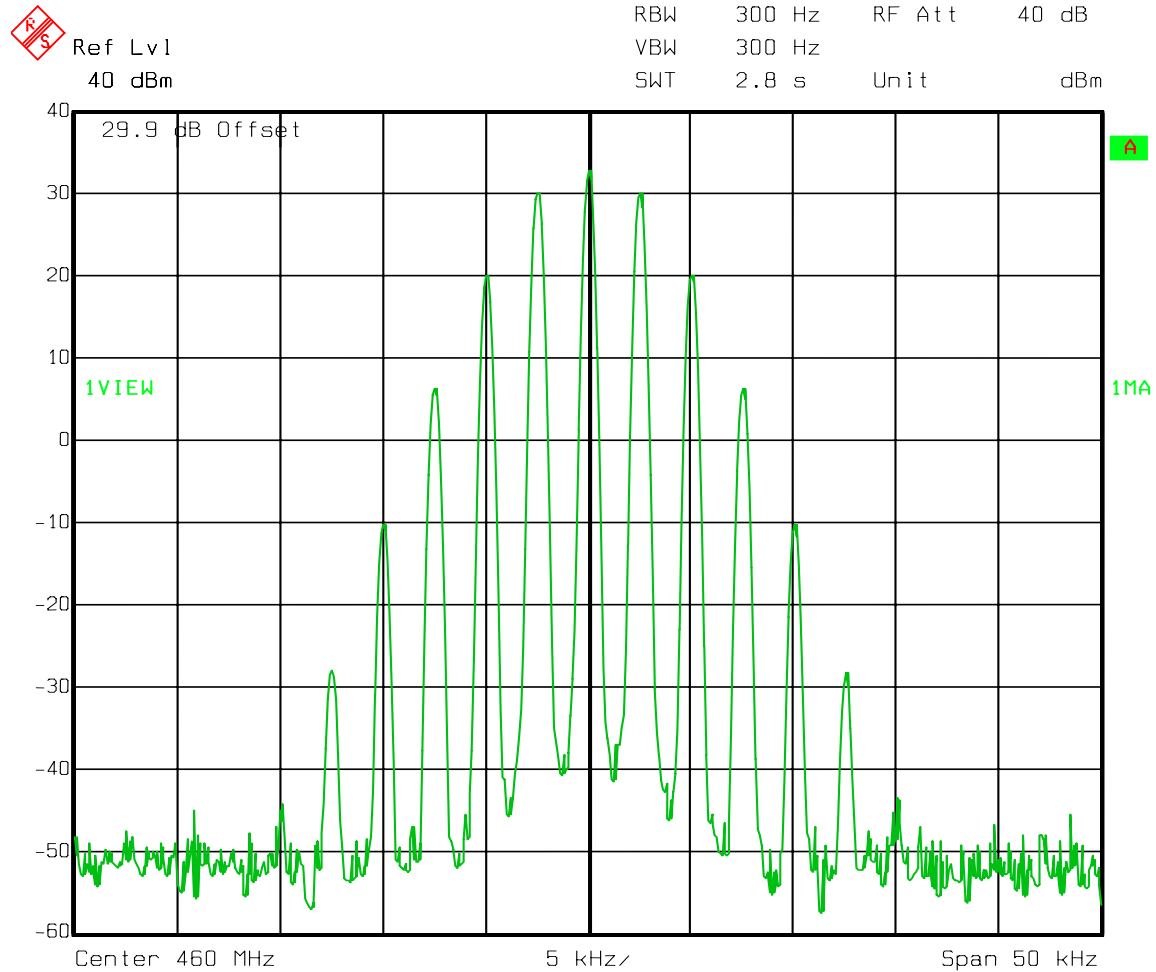
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EQUIPMENT: FS31H-4X-USR

### Test Data – Occupied Bandwidth

Uplink / Output

2.5 kHz Tone / 3 kHz Deviation

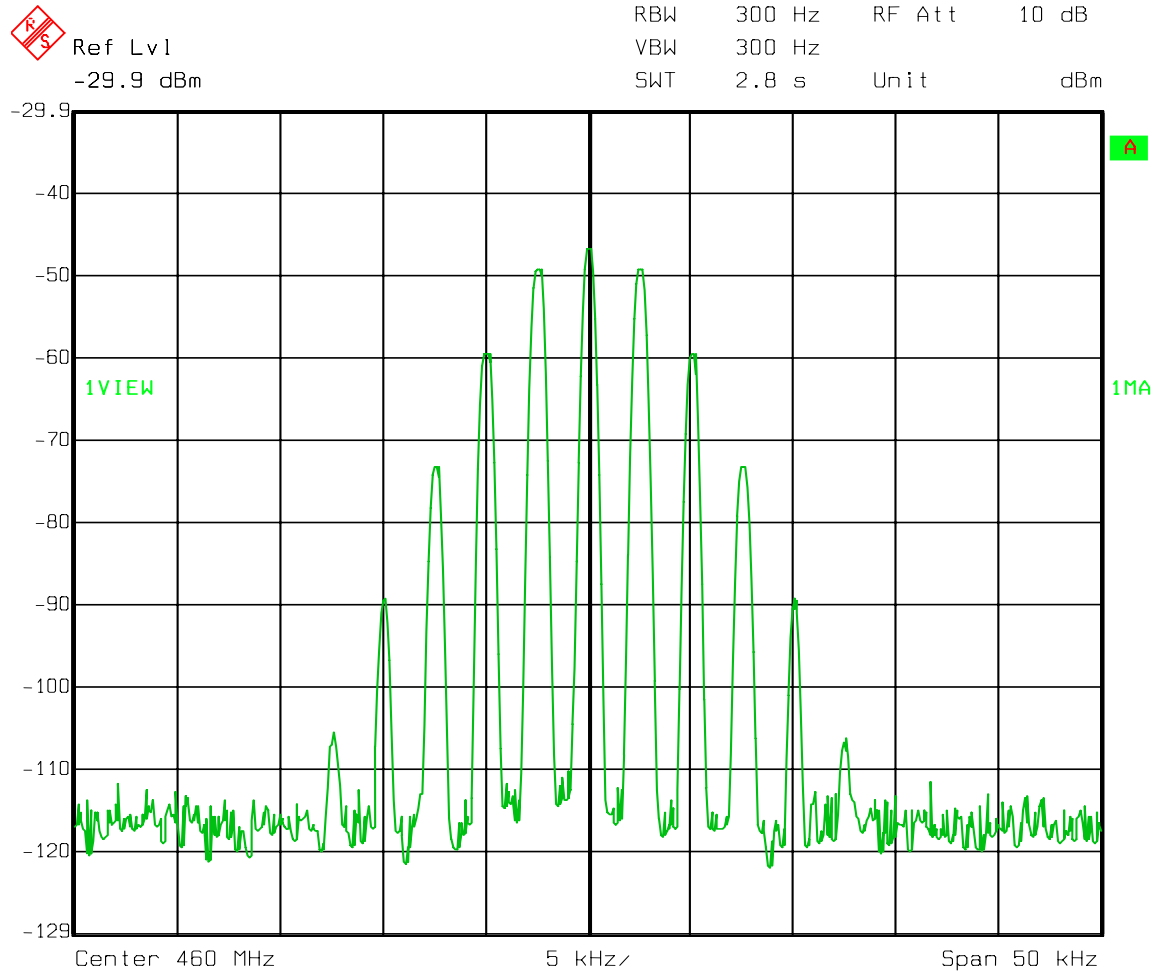


Date: 26.JUN.2008 09:34:44

EQUIPMENT: FS31H-4X-USR

**Test Data – Occupied Bandwidth**

Uplink / Input  
2.5 kHz Tone / 3 kHz Deviation



Date: 26.JUN.2008 09:36:13

## **Section 5. Spurious Emissions at Antenna Terminals**

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: David Light	DATE: 25 June 2008

**Test Results:** Complies.

**Test Data:** See attached plot(s).

**Equipment Used:** 1659-1082-1472-1469

**Measurement Uncertainty:** +/- 1.7 dB

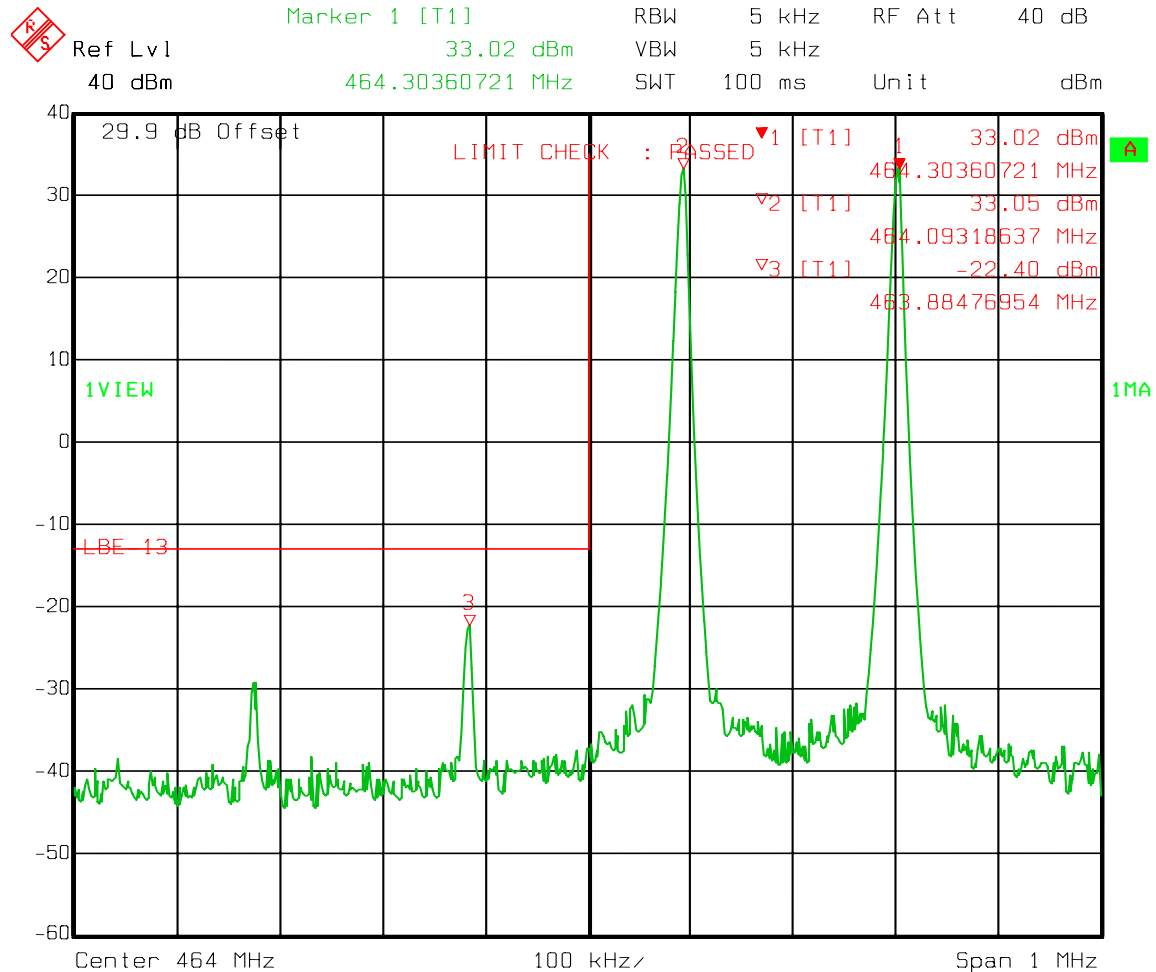
**Temperature:** 22 °C

**Relative Humidity:** 35 %

EQUIPMENT: FS31H-4X-USR

# Test Data – Spurious Emissions at Antenna Terminals

Low Band Edge  
Downlink



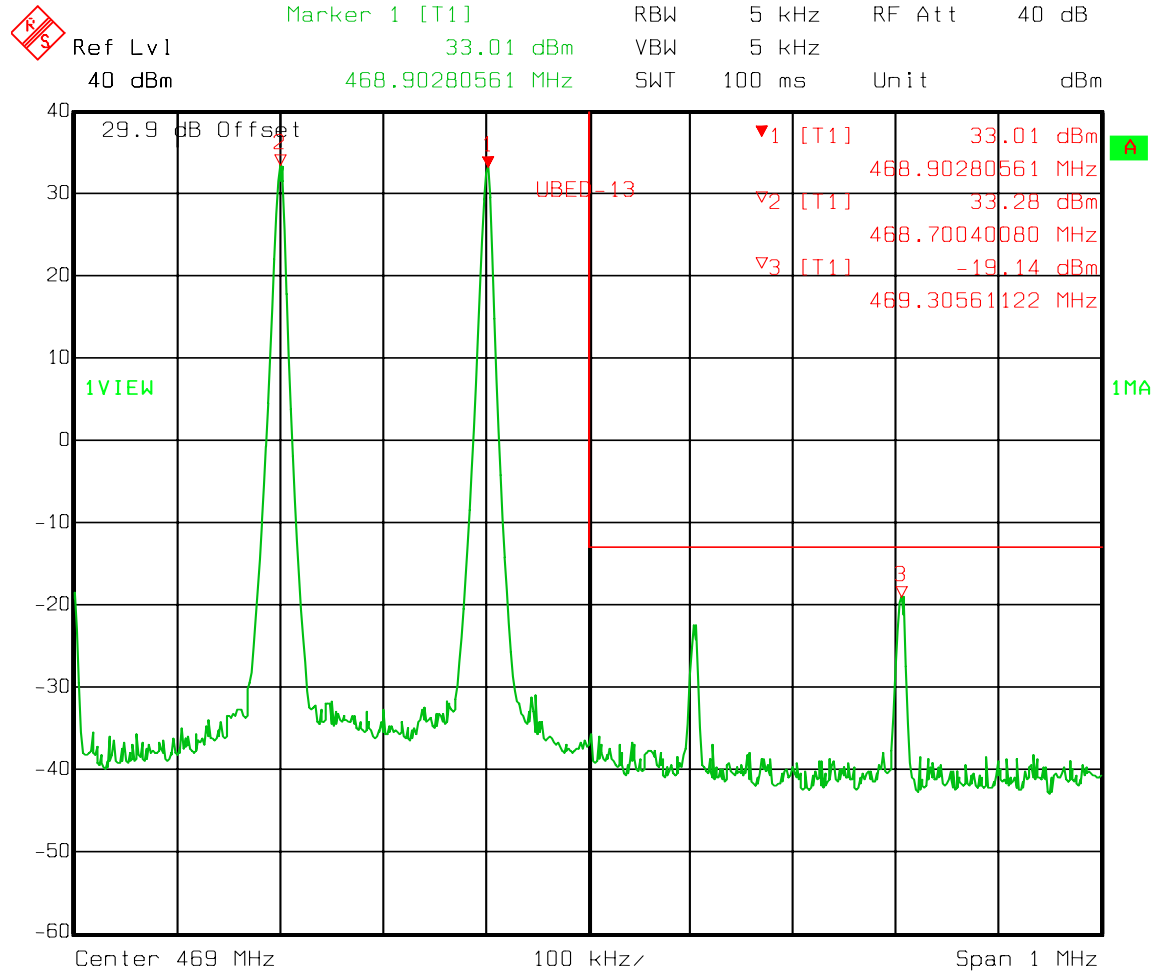
Date: 26.JUN.2008 09:50:15

EQUIPMENT: FS31H-4X-USR

# Test Data – Spurious Emissions at Antenna Terminals

Upper Band Edge

Downlink

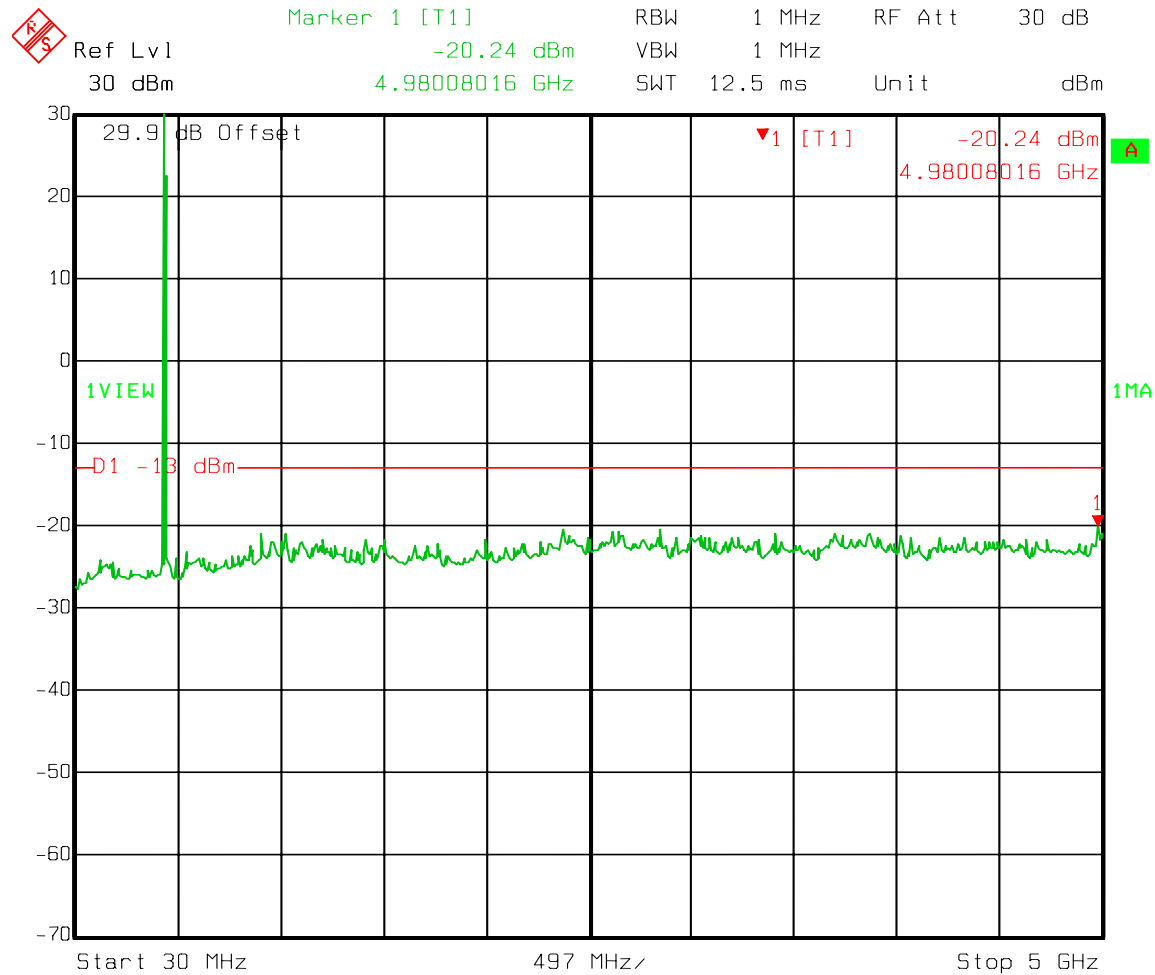


Date: 26.JUN.2008 09:08:33

EQUIPMENT: FS31H-4X-USR

# Test Data – Spurious Emissions at Antenna Terminals

Spurs  
Downlink



Date: 26.JUN.2008 09:02:44

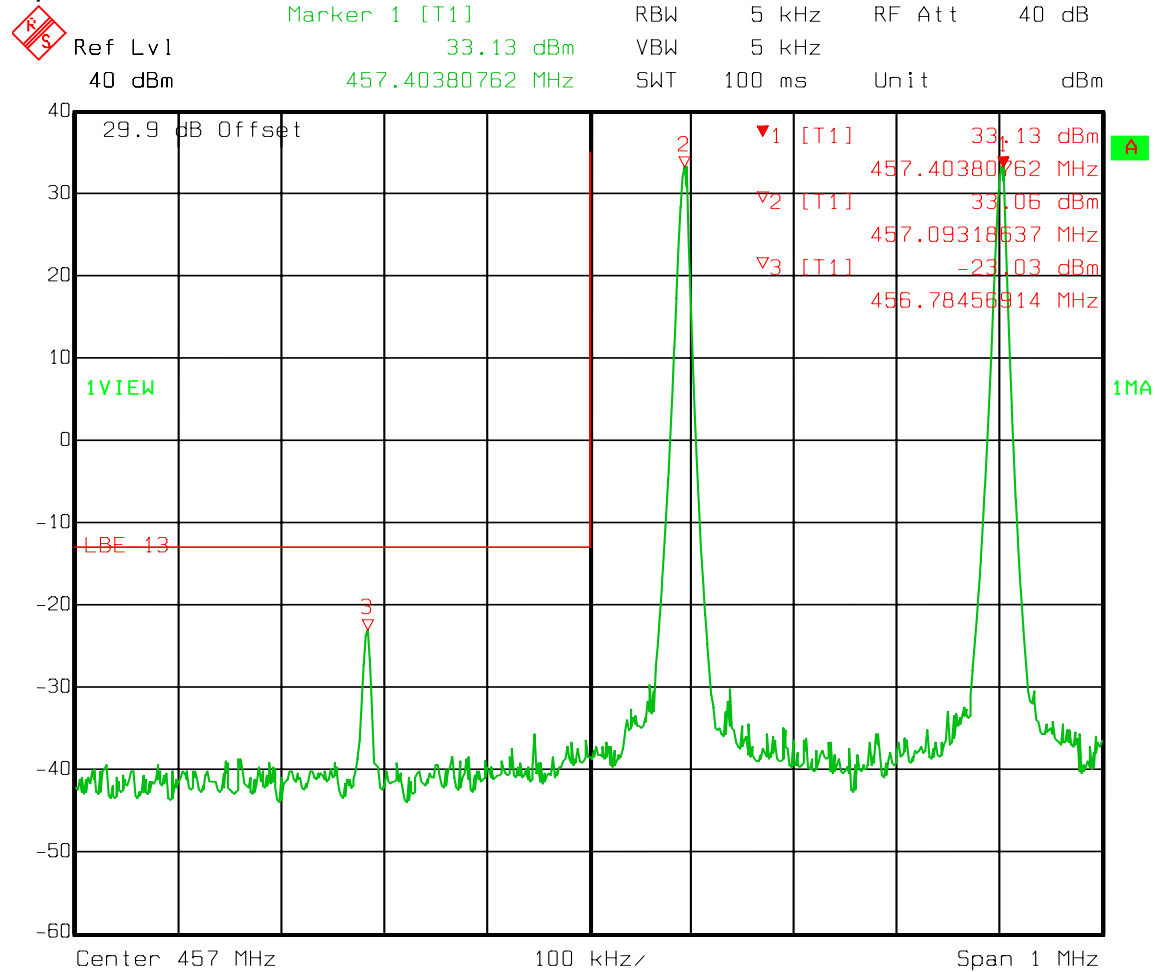


EQUIPMENT: FS31H-4X-USR

# Test Data – Spurious Emissions at Antenna Terminals

Low Band Edge

Uplink



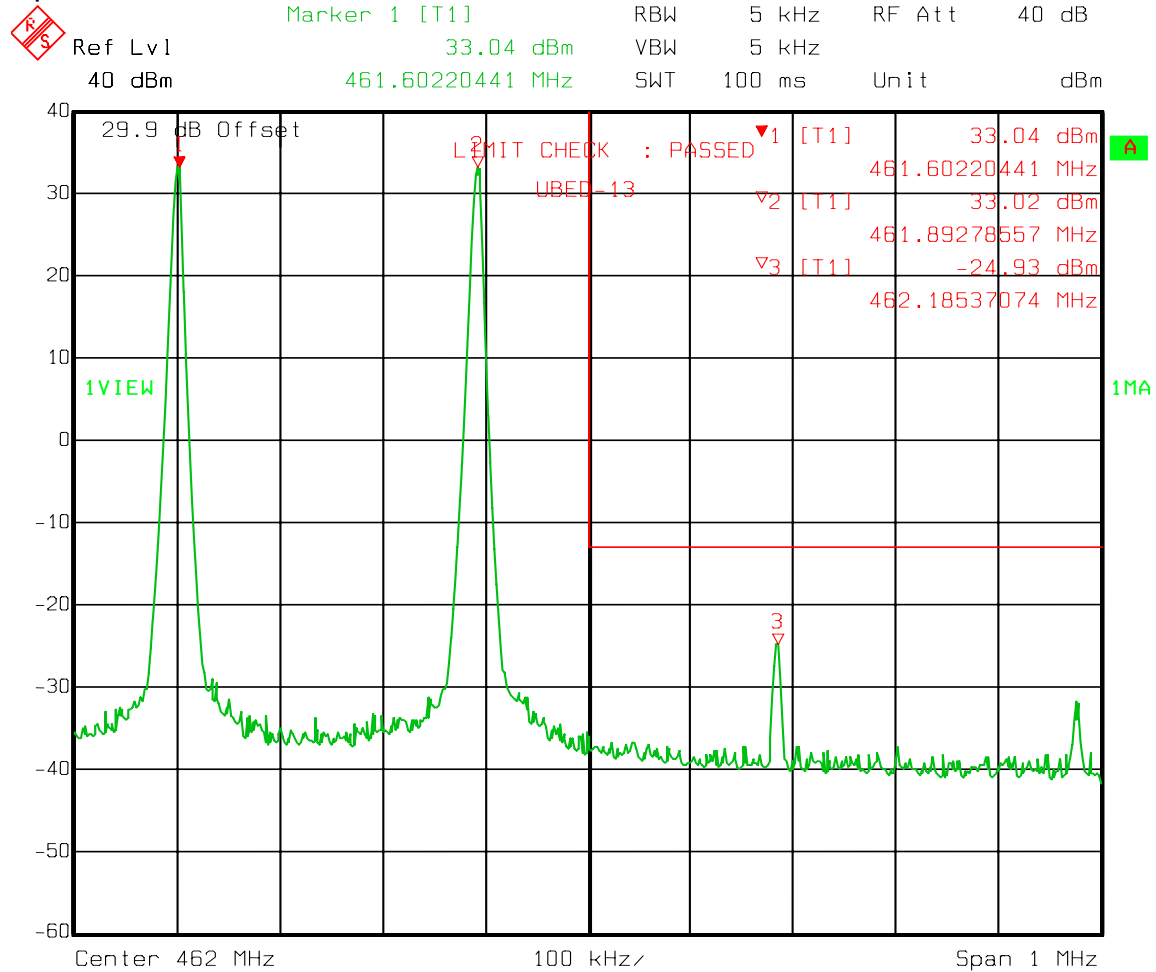
Date: 26.JUN.2008 10:13:36

EQUIPMENT: FS31H-4X-USR

# Test Data – Spurious Emissions at Antenna Terminals

Upper Band Edge

Uplink

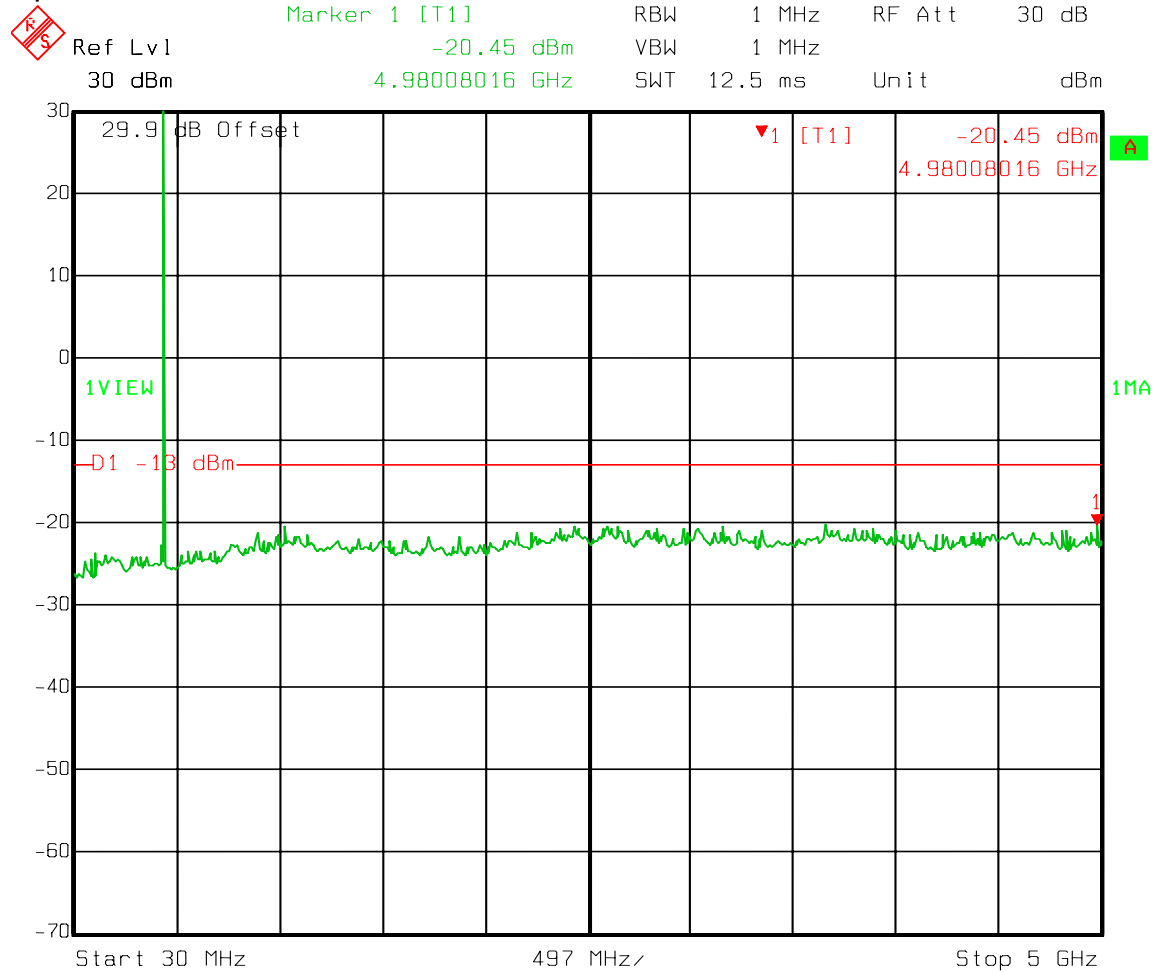


Date: 26.JUN.2008 10:11:09

EQUIPMENT: FS31H-4X-USR

# Test Data – Spurious Emissions at Antenna Terminals

Spurs  
Uplink



Date: 26.JUN.2008 09:37:45

**Section 6. Field Strength of Spurious Emissions**

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: David Light	DATE: 25 June 2008

**Test Results:** Complies.**Test Data:** There were no emissions detected within 20 dB of the specification limit of -13 dBm, therefore none are reported per 2.1057(c).**Analyzer Settings:** Frequencies < than 1000 MHz: RBW/VBW = 100 kHz  
Frequencies > than 1000 MHz: RBW/VBW = 1 MHz  
Peak detector

The spectrum was searched from 30 MHz to 5 GHz.

**Equipment Used:** 993-1484-1485-1016-993**Measurement Uncertainty:** +/-1.7 dB**Temperature:** 22 °C**Relative Humidity:** 35 %**Note:** See page A5 for applicable limit.

**Section 7. Test Equipment List**

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1659	Spectrum Analyzer	Rhode & Schwarz FSP	973353	01/24/07	01/24/09
1082	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
1472	20db Attenuator DC 18 Ghz	Omni Spectra 20600-20db	NONE	CBU	N/A
1469	10 db Attenuator DC 18 Ghz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU	N/A
1484	Cable	Storm PR90-010-072	N/A	05/07/08	05/07/09
1485	Cable	Storm PR90-010-216	N/A	05/07/08	05/07/09
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/31/07	08/30/08
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/24/07	01/24/09
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	05/07/08	05/07/09

## **ANNEX A - TEST METHODOLOGIES**

<b>NAME OF TEST: RF Power Output</b>	<b>PARA. NO.: 2.985</b>
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**Minimum Standard:** Para. No. 90.205(a). The maximum allowable station ERP is dependent upon the stations HAAT and required service area and will be authorized in accordance with Table 1 of 90.205(d).

**Method Of Measurement:**

Detachable Antenna:

The peak power at antenna terminals is measured using an in-line peak power meter. Power output is measured with the maximum rated input level.

Integral Antenna:

The antenna substitution method is used to determine the equivalent radiated power at spurious frequencies. The spurious emissions are measured at a distance of 3 meters. The EUT is then replaced with a reference substitution antenna with a known gain referenced to an isotropic radiator. This antenna is fed with a signal at the spurious frequency. The level of the signal is adjusted to repeat the previously measured level. The resulting eirp is the signal level fed to the reference antenna corrected for gain referenced to an isotropic radiator.

**NAME OF TEST: Spurious Emissions at Antenna Terminals**

**PARA. NO.: 2.991**

**Minimum Standard:**

90.210, Table 1

**Table 1**

Frequency Band (MHz)	Mask for equipment with Low Pass Filter	Mask for equipment without Low Pass Filter
Below 25	A or B	A or C
25 - 50	B	C
72 - 76	B	C
150 - 174	B, D or E	C, D or E
150 Paging only	B	C
220 - 222	F	F
421 - 512	B, D or E	C, D or E
450 paging only	B	H
806 - 821/ 851 - 866	B	G
821 - 824/ 866 - 869	B	H
896 - 901/ 935 - 940	I	J
902 - 928	K	K
929 - 930	B	G
Above 940	B	C
All other bands	B	C

MASK	Spurious Limit	FS Limit Below 1 GHz	FS Limit Above 1 GHz
A,B,C,G,H,I	-13dBm	84.4 dB $\mu$ V/m@3m	82.2 dB $\mu$ V/m@3m
D,J	-20dBm	77.4 dB $\mu$ V/m@3m	75.2 dB $\mu$ V/m@3m
E,F,K	-25dBm	72.4 dB $\mu$ V/m@3m	70.2 dB $\mu$ V/m@3m

**Test Method:**

RBW: 1% of emission bandwidth in the 0 - 1 GHz range.  
1 MHz at frequencies above 1 GHz.

VBW:  $\Rightarrow$  RBW

The spectrum is searched up to 10 times the fundamental frequency.



<b>NAME OF TEST: Occupied Bandwidth</b>	<b>PARA. NO.: 2.989</b>
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**Minimum Standard:** Not defined. Input/Output

**Method Of Measurement:**

Analog

Spectrum analyzer settings:

RBW=VBW=300 Hz

Span: 100 kHz

Sweep: Auto

iDEN

RBW=VBW= 300 Hz

Span: 100 kHz

Sweep: Auto

**NAME OF TEST: Field Strength of Spurious****PARA. NO.: 2.993****Minimum Standard:** Para. No. 90.210, see table 1 for applicable mask.**Method Of Measurement:** TIA/EIA-603-1992

The antenna substitution method is used to determine the equivalent radiated power at spurious frequencies. The spurious emissions are measured at a distance of 3 meters. The EUT is then replaced with a reference substitution antenna with a known gain referenced to an isotropic radiator. This antenna is fed with a signal at the spurious frequency. The level of the signal is adjusted to repeat the previously measured level. The resulting eirp is the signal level fed to the reference antenna corrected for gain referenced to an isotropic radiator.

<b>MASK</b>	<b>Spurious Limit</b>	<b>FS Limit Below 1 GHz</b>	<b>FS Limit Above 1 GHz</b>
A,B,C,G,H,I	-13dBm	84.4 dB $\mu$ V/m@3m	82.2 dB $\mu$ V/m@3m
D,J	-20dBm	77.4 dB $\mu$ V/m@3m	75.2 dB $\mu$ V/m@3m
E,F,K	-25dBm	72.4 dB $\mu$ V/m@3m	70.2 dB $\mu$ V/m@3m

**NAME OF TEST: Frequency Stability****PARA. NO.: 2.995**

**Minimum Standard:** Para. No. 990.213. The transmitter carrier frequency shall remain

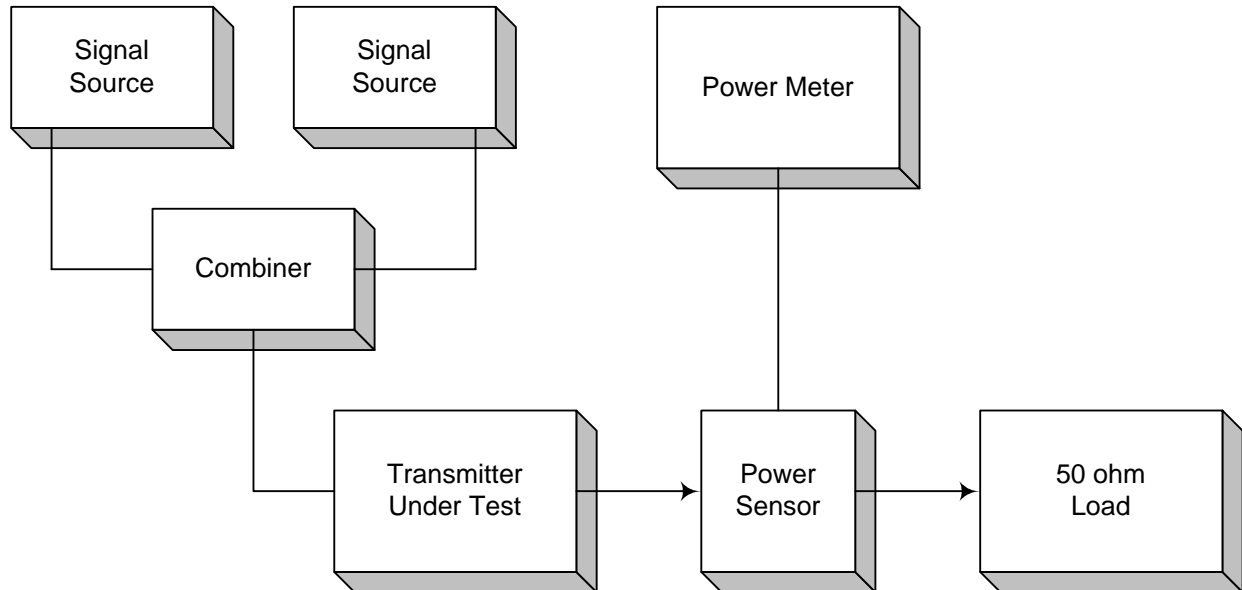
within the assigned frequency below in ppm.

**Table 2**

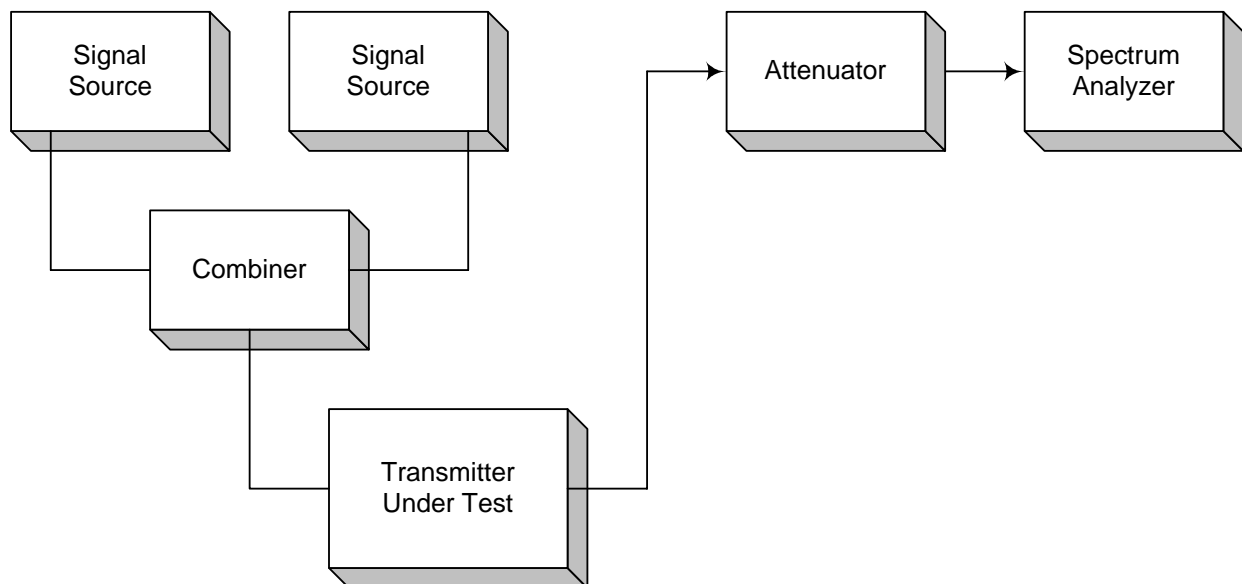
Frequency Band (MHz)	Fixed And Base Stations	Mobile Stations	
		> 2 Watts o/p pwr	< 2 Watts o/p pwr
Below 25	100	100	200
25 - 50	20	20	50
72 - 76	5	-	50
150 - 174	5	5	5
220 - 222	0.1	1.5	1.5
421 - 512	2.5	5	5
806 - 821	1.5	2.5	2.5
821 - 824	1.0	1.5	15
851 - 866	1.5	2.5	2.5
866 - 869	1.0	1.5	1.5
869 - 901	0.1	1.5	1.5
902 - 928	2.5	2.5	2.5
929 - 930	1.5	-	-
935 - 940	0.1	1.5	1.5
1427 - 1435	300	300	300
Above 2450	-	-	-

## **ANNEX B - TEST DIAGRAMS**

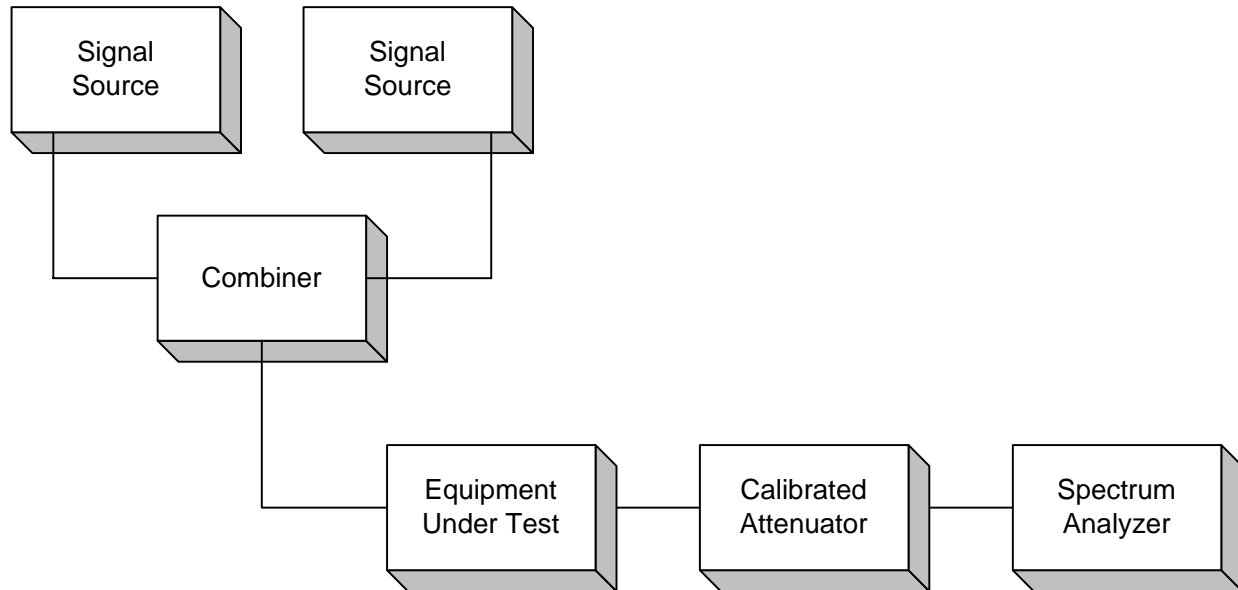
**Para. No. 2.985 - R.F. Power Output**



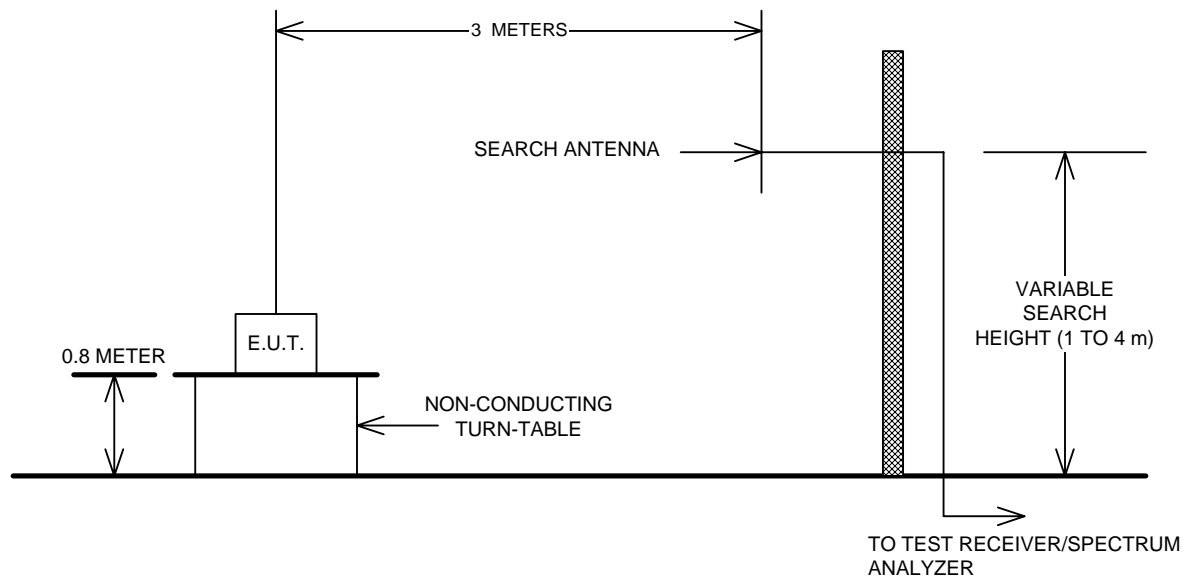
**Para. No. 2.989 - Occupied Bandwidth**



**Para. No. 2.991 - Spurious Emissions at Antenna Terminals**



**Para. No. 2.993 - Field Strength of Spurious Radiation**



**Para. No. 2.995 - Frequency Stability**

